Urinalysis

Cloudy/milky
- Phosphaturia (commonest – crystal precipitate in high pH)
- Pyuria
- Chyluria

Red
- Hematuria
- Hemoglobinuria/myoglobinuria
- Anthrocyanin in beets and blackberries
- Chronic lead and mercury poisoning
- Phenolphthalein (in bowel evacuants)
- Phenothiazines
- Rifampin

Orange
- Dehydration
- Phenazopyridine (Pyridium)
- Sulfasalazine (Azulfidine)

Yellow
- Normal
- Phenacetin
- Riboflavin

Green-blue
- Biliverdin
- Indicanuria (tryptophan indole metabolites)
- Amitriptyline (Elavil)
- Indigo carmine
- Methylene blue
- Phenois (e.g., IV cimetidine [Tagamet],
- IV promethazine [Phenergan])
- Resorcinol
- Triamterene (Dyrenium)

Brown
- Urobilinogen
- Porphyria
- Aloe, fava beans, and rhubarb
- Chloroquine and primaquine
- Furazolidone (Furoxone)
- Metronidazole (Flagyl)
- Nitrofurantoin (Furadantin)

Brown-black
- Alcaptonuria (homogentisic acid)
- Hemorrhage
- Melanin
- Tyrosinosis (hydroxyphenylpyruvic acid)
- Cascara, senna (laxatives)
- Methocarbamol (Robaxin)
- Methyldopa (Aldomet)
- Sorbitol

Variable	Normal value	High	Low
Specific gravity*	1.001 – 1.035	>1.020 Dehydration Diuretics DM	<1.008 Overhydration Impaired conc. DI
Urine osmolality	50 – 1200 mosm/l	As above	As above
pH	5.5 – 6.5	>6.5 Proteus RTA 1 and 2	<5.5 Cystinuria Uricosuria
Protein	< 20 mg/dl		

* can be measured on dipstick/ osmolality cannot

Haematuria

> 3RBCs/hpf suggestive of significant haematuria on microscopy

Dipstick testing

- Detects haematuria, haemoglobinuria and myoglobinuria
- Cells lysed on contact with reagent strip.
- Peroxidase activity of haemoglobin/ myoglobin utilised vs. organic peroxidase substrate (orthotolidine).
- Oxidation of chromagen substrate indicates presence of haemoglobin of myoglobin
- Overall sensitivities 90-100% c.f. microscopy (2-5 rbcs/ hpf) [Woolhandler JAMA 1989]; Overall specificities 65-99% cf. microscopy
  - False positives:
    - Menstrual bleeding
    - Dehydration
    - Haemoglobin
    - Myoglobin
    - Oxidised reagent strips
  - False negatives:
    - Vitamin C

No studies directly compare dipstick positivity with presence of significant urological disease.

Incidence of urological malignancy with microscopic haematuria:

Asymptomatic overall	~ 0.5 - 2.0%
Asymptomatic > 50 yrs	~ 5%
Symptomatic > 50 yrs	~ 10%
Macroscopic haematuria	~ 25%

Screening for haematuria not recommended at present as PPV too low (0.5%)

NB. haematuria/RBC casts and proteinuria (>100mg/dL or 2+) indicative of renal glomerular disease. Top 3:

IgA nephropathy (Berger's disease)	30%
Mesangioproliferative GN	14%
Focal segmental proliferative GN	13%

Proteinuria

Normally 80-150mg protein excreted in urine per day

30% albumin; 30% globulin; 40% TH protein

Concentration rarely exceeds 20mg/dl (not detected on dipstick)
Dipstick contains tetrabromophenol – turns blue with albumin
Positive when protein conc > 20mg/dl
High specificity; low sensitivity
False negatives:
- High urinary pH
- Dilute urine
- Non-albumin proteinuria (Bence-Jones proteins in myeloma)

Urine dipstick testing for UTI

Urinary nitrite and leukocyte esterase surrogates for bacteria and WBC respectively. Reference bacteruria > 10^5 orgs/ml
Early morning urine has increased sensitivity
Urinary Nitrite
- Dietary nitrates - urinary nitrates - nitrate reducing bacteria (enterobacteria) -urinary nitrites - react with amine-impregnated dipstix reagent - pink diazonium compound
- Sensitivity = 35-85%, Specificity = 92-100%
- False positives:
  - Contamination
- False negatives:
  - Non–enteric bacteria
  - Dilute urine/ frequent voiding
  - Vitamin C
  - High osmolality/ urinary H+
  - Urobilinogen

Urinary Leukocyte Esterase
- LE from neutrophil/ basophil granules reacts with reagent strip - indoxyl moeity produces colour changes by oxidation of diazonium salt
- Sensitivity = 72-97%, Specificity = 64-82%
- False positives
  - Specimen contamination
- False negatives
  - Old specimen (leucocyte lysis)
  - High osmolality/specific gravity
  - Vitamin C
  - Urobilinogen

When Nitrite and LE combined; Sensitivity = 70-100%, Specificity = 60-98%

Glucose and Ketones

Double oxidation reaction: glucose – gluconoic acid and hydrogen peroxidase – colour change
Very sensitive for any glucose in urine (corresponds to renal threshold of 180mg/dL)
Specific for glucose – not other sugars
Ketone testing specific for acetoacetic acid, not acetone or hydroxybutyrate

Urine microscopy and culture

Clean catch MSU specimen

First voided morning specimen – examine within one hour

Centrifuged samples 5 mins at 3000rpm – resuspend

Examine at low power (100x) and high power (400x) 1 hpf = 1/20,000 ml

Routine examination for:

RBCs	Up to 3/hpf normal
RBC casts	Glomerulonephritis
WBCs	> 10wbc/hpf = significant inflammation
	1-2/hpf normal in men
	Up to 5/hpf normal in women
WBC casts	Pyelonephritis
Bacteria	5/hpf = 100,000/ml*